

### SUPPORT FOR THE AMENDMENT

This Amendment cancels withdrawn Claims 15-42; amends Claims 12-14; and adds new Claims 43-48. Support for the amendments is found in the specification and claims as originally filed. In particular, support for claim 43 is found at least in Figs. 1-3 ("2 particles/100 $\mu\text{m}^2$  or less of carbides"). Support for new Claims 44-46 is found in Claims 12-14. Support for new Claim 47 is found in Claim 11 and in the specification at least at page 1, lines 25-26, and page 4, line 13, 21 and 28. Support for new Claim 48 is found in the specification at least at page 6, lines 24-25. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 11-14 and 43-48 will be pending in this application. Claim 11 is independent.

### REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention provides a hard-drawn steel wire allowing springs made of the wire to exhibit excellent fatigue strength and sag resistance even without subjecting a drawn wire to quenching and tempering treatments. Specification at page 1, lines 7-9.

Claims 11, 13 and 14 are rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,224,686 ("Aoki").

Claims 11, 13 and 14 are also rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,904,787 ("Matsumoto").

Claim 12 is rejected under 35 U.S.C. §103(a) over Aoki or Matsumoto, and further in view of Japanese Patent No. 405320827 ("JP-827").

Aoki discloses a valve spring formed from an oil-tempered steel wire, in which the density of carbides larger than  $0.05\text{ }\mu\text{m}$  in diameter is no more than  $5\text{ pieces}/\mu\text{m}^2$ . Aoki at Claim 1. Aoki's oil-tempered wire is a quenched and tempered wire and has a tempered martensite structure. Aoki at column 3, lines 1-3; column 4, line 56. The tempered martensite structure of Aoki's wire provides high strength and excellent fatigue strength and sag resistance. Specification at page 1, lines 19-21.

Matsumoto discloses a quenched, oil-tempered wire that consists essentially of martensite and austenite and in which the number of carbide particles having a diameter  $0.05\text{ }\mu\text{m}$  or more is 5 or less per  $\mu\text{m}^2$ . Matsumoto at Claim 1. The tempered martensite structure of Matsumoto's wire provides high strength and excellent fatigue strength and sag resistance. Specification at page 1, lines 19-21.

However, the tempered martensite structure of the wires of Aoki and Matsumoto fails to suggest the independent Claim 11 limitation of steel wire that is "hard-drawn". A "hard-drawn wire" is produced by drawing carbon steel with a ferrite-pearlite structure or a pearlite structure to obtain a wire having enhanced strength. Specification at page 1, lines 24-26.

In contrast to the oil-tempered wires containing martensite of Aoki and Matsumoto, conventional hard-drawn wires, drawn from carbon steel with a ferrite-pearlite structure or a pearlite structure, provide only hard-drawn springs with lower fatigue strength and sag resistance. Specification at page 1, line 24 to page 2, line 4. However, the hard-drawn wire of the present invention exhibits excellent fatigue strength and sag resistance, without quenching and tempering, by controlling the composition of the wire and the morphology of carbides in the wire. Specification at page 3, lines 16-19.

JP-827 fails to remedy the deficiencies of Aoki and Matsumoto. The Office Action at section 8 cites JP-827 for disclosing a steel containing Ni.

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant improvement in tensile strength, residual shear strain (sag resistance) and fatigue life that is achieved by the present invention by limiting the number of carbides having a circle-equivalent diameter of  $0.1\mu\text{m}$  or more to 5 particles/ $100\mu\text{m}^2$  or less. See Figs. 1-3 (reproduced below) and specification at page 12, lines 5-6 and 16-17.

FIG.1

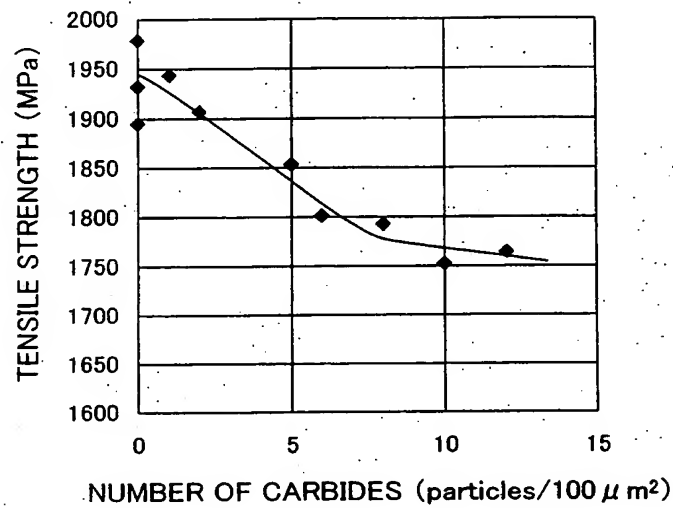


FIG.2

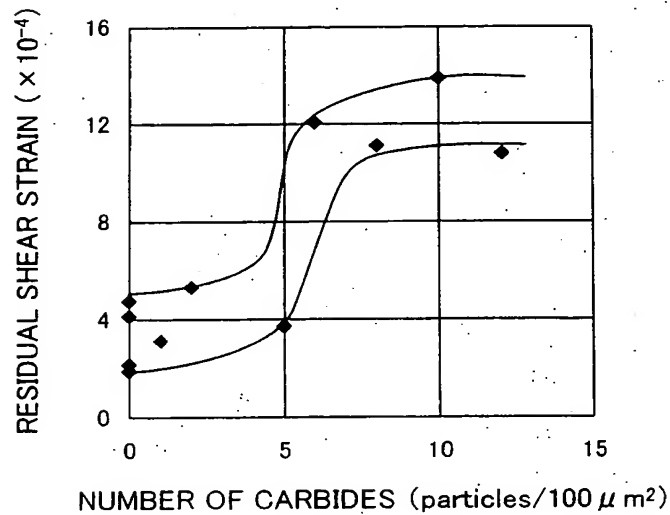
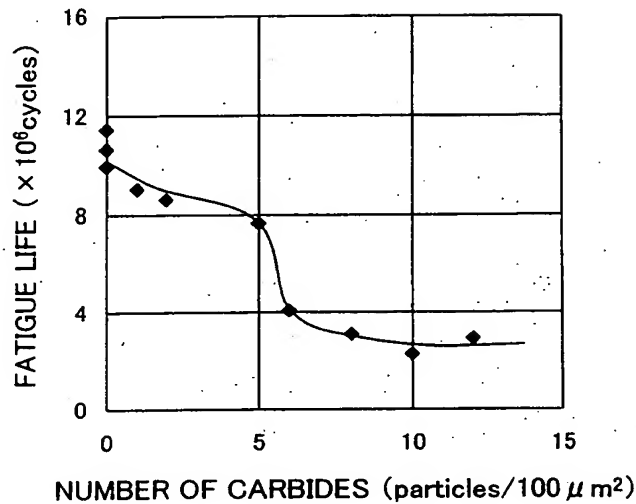


FIG.3



Aoki discloses that carbide particles larger than 0.05 μm in diameter may generate cracks in the microscopic structure in forming a valve spring or in other manufacturing stages, and that if the density of the microscopic structure exceeds 5 pieces/μm<sup>2</sup>, the toughness remarkably deteriorates. Aoki at column 4, lines 63-67.

Matsumoto discloses that the reason why the number of carbides 0.05μm or more in particle diameter is restricted to 5 or less per μm<sup>2</sup> is because carbides having diameters of 0.05 μm or more can be starting points of destruction while forming springs, and that thus if the number of such carbides exceeds 5 per μm<sup>2</sup>, the toughness of the wire will drop markedly. Matsumoto at column 3, lines 13-19.

However, the cited prior art fails to suggest that limiting the number of carbide particles having circle-equivalent diameters of 0.1 μm or more to 5 particles/100μm<sup>2</sup> or less in accordance with independent Claim 11 will significantly improve tensile strength, residual

shear strain (sag resistance) and fatigue life. Thus, any *prima facie* case of obviousness based on the cited prior art is rebutted.

Because the cited prior art fails to suggest the "hard-drawn" steel wire of independent Claim 11, and any *prima facie* case of obviousness is rebutted, the rejections under 35 U.S.C. § 103(a) should be withdrawn.

New Claim 47 is further patentably distinguishable over the cited prior art, because the cited prior art fails to suggest the Claim 47 limitation that "the steel wire consists of at least one selected from the group consisting of ferrite and pearlite".

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

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